APPENDIX G

Salmonid Use of the Snoqualmie River - Tolt Delta Reach

Salmonid Use of the Snoqualmie River–Tolt Delta Reach

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TABLE OF CONTENTS

INTRODUCTION

King County Wastewater Treatment Division has been contracted by the City of Carnation to construct and operate a wastewater treatment facility (WWTF) by December 2007. At full capacity, the plant will have an annual average effluent flow at design year (2030) of 0.37 MGD (0.57 cfs) treated to tertiary treatment levels. Further, King County has committed to meet or exceed federal and state regulatory requirements. Despite this level of treatment, there may be very low levels of some metals and endocrine disrupter compounds in the effluent. Therefore, to further assess and reduce potential risk associated with effluent discharge, the question of whether to discharge directly into the river at one of two points (Tolt-MacDonald Park or Carnation Farm Road bridge) is being weighed against a discharge into off-channel wetlands (existing or constructed) in the WDFW-owned Stillwater Wildlife Area, located about three miles down-valley. This report addresses fish use of mainstem reach for the purpose of assessing relative risk to salmonids of the two river discharge options and any non-mainstem discharge options.

PHYSICAL SETTING

The Snoqualmie River is the largest (693 sq. mi.) of the six major rivers in King County. The 270 ft high Snoqualmie Falls (at RM 40.3) is a natural barrier to anadromous salmonids and divides the watershed into lower and upper reaches. Above the Falls, the Snoqualmie River drains steep, mountainous terrain with drainage channels confined by bedrock (Bethel 2004). Below the Falls, the river occupies a broad low gradient, post-glacial trough with a very low sustained gradient of 0.046% over 40 miles (Martin and Benda, 2004) relative to other Puget Sound rivers. The broad valley and low gradient create a river channel that is mostly meandering and slough-like with substrates dominated by sand and silt. As a result, the lower river is largely unsuitable for salmonid spawning with two major exceptions: where it flows over the Raging and Tolt River delta fans. These fans constrict the Snoqualmie River causing locally steep gradients and deposition of gravel suitable for extensive salmon spawning. The City of Carnation is located on the Tolt River delta fan. The two possible locations for river discharge of highly treated effluent are proposed in this reach of the Snoqualmie.

SALMONID USE

OVERVIEW

The Tolt Delta Reach (TDR) of the Snoqualmie River is used by nine species of salmonids: Chinook, chum, pink, coho and sockeye salmon, steelhead, cutthroat and bull trout and mountain whitefish. In particular, the value of this reach as a high use/high quality spawning area for Chinook, chum and pink salmon and steelhead trout is well-known. Thirty years ago, Williams et al. (1975) described fish use in this reach and noted it as having good to excellent gravel composition. Because of its value for spawning, the Washington Department of Fish and Wildlife has been using this reach as an index area to assess salmonid spawning and run size abundance for several decades.

Similar conclusions about the TDR's value for salmonids, and especially for Chinook salmon, are reached in a number of major reports including WDFW et al. (1994), Pentec (1999), WDFW and WWTIT (1994), Snohomish Basin Salmon Recovery Forum (2001), Haring (2002) and the recently completed draft WRIA 7 Salmon Conservation Strategy (Snohomish County 2005)

The Salmonid Habitat Limiting Factors Analysis Snohomish River Watershed–WRIA 7

Final Report (Haring 2002) said the following about salmonid use and value of the TDR:

> "Mainstem Snoqualmie River from the mouth of Harris Creek to the mouth of the Tolt River – This area has a significant concentration of high quality spawning habitat and diversity of salmonid use. This 3-mile reach is one of two reaches of the Snoqualmie River that provide spawning habitat for anadromous salmonids. About 20% of the Chinook salmon that return to the Snoqualmie River watershed spawn in this area. Approximately 50% of the shorelines in this reach are in public ownership, providing considerable opportunity to restore impaired habitat functions."

CHINOOK SALMON

Perhaps because of the TDR's well-known value for Chinook spawning and listing of Puget Sound Chinook as threatened under the federal Endangered Species Act, more is known about Chinook use in this area than for other salmonids. Table 1 summarizes WDFW Chinook spawner data since 1999. (Note: The TDR is the same as the Snoqualmie (RM 20.5-24.9) reach). Of the six mainstem river reaches surveyed (i.e., excluding Tokul, Cherry and Griffin Creeks), the TDR had the second highest six-year average (480 fish/year) and density (109 fish/mi) of spawners, second only to the Raging River delta reach, which had 824 and 123 total and density of spawners, respectively.

Table 1. Snoqualmie Chinook Escapement Estimates 1999-2004 (compiled by James Schroeder, King County DNRP)

Subbasin	1999	2000	2001	2002	2003	2004
Snoqualmie (RM 20.5-24.9)*	183		658	760	333	715
Snoqualmie (RM 32.9-39.6)	440	643	865	1,240	845	913
Tokul (RM 0.0-0.3)	347	128	215	123	265	538
Tokul (RM 0.3-0.6)				25	3	5
Raging (RM0.0-4.6)	130	180	1,213	118	188	428
Tolt (RM 0.0-4.6)	138	148	343	455	210	240
Tolt (RM 6.0-8.7)	68	60	168		70	79
SF Tolt (RM 0.0-1.6)	38	40	40	10	63	72
Cherry			43			
Griffin			45			
TOTAL**	**1,344**	**1,427**	**3,590**	**2,731**	**1,977**	**2,990**

* The Tolt Delta Reach

** Does not include Snoqualmie population spawning in mainstem Snohomish

Furthermore, for Chinook salmon, the Snohomish Basin Near Term Action Agenda (Snohomish Basin Salmon Recovery Forum 2001) identified the TDR as one of twelve focus areas in the Snohomish River basin considered critical for protection and restoration efforts. Martin and Benda (2004) used reach and valley scale geomorphic indicators and detailed data on Chinook spawner spatial use patterns and found

that the TDR qualified as one of two core areas (i.e., areas of intense spawning use) for Chinook in the Snoqualmie River.

Within the TDR, number and density of Chinook spawning above Carnation Farm Road bridge is slightly higher than below based on 2004 surveys (Chad Jackson, WDFW, February 23, 2005 e-mail). In 2004, above the Carnation Farm Road bridge (a two-mile reach extending from the mouth of the Tolt River downstream to the bridge), the estimated density of Chinook redds averaged 86.5 redds/mile while below the bridge (extending 1.5 miles downstream from the bridge), the average estimated redd density was 75.3 redds/mile. A map of 2004 redd locations using WDFW data was produced by Benn Burke, Adolfson Associates (Figure 1). The map shows areas of high intensity spawning based on three boat and aerial surveys (September 24, October 14–15, and October 27). Above the bridge most Chinook spawn in two clusters. One cluster starts roughly at the footbridge and extends downstream for about 1,500 feet. The other cluster starts roughly 4,200 feet from the footbridge and extends for about 800 feet downstream. Below the bridge, the primary area of high intensity spawning starts roughly 1,500 feet downstream the bridge and extends for about 1,000 feet. These areas are approximate and may shift due to changes in substrate and flows. However, they give a sense of the highest use areas for Chinook spawning within the reach.

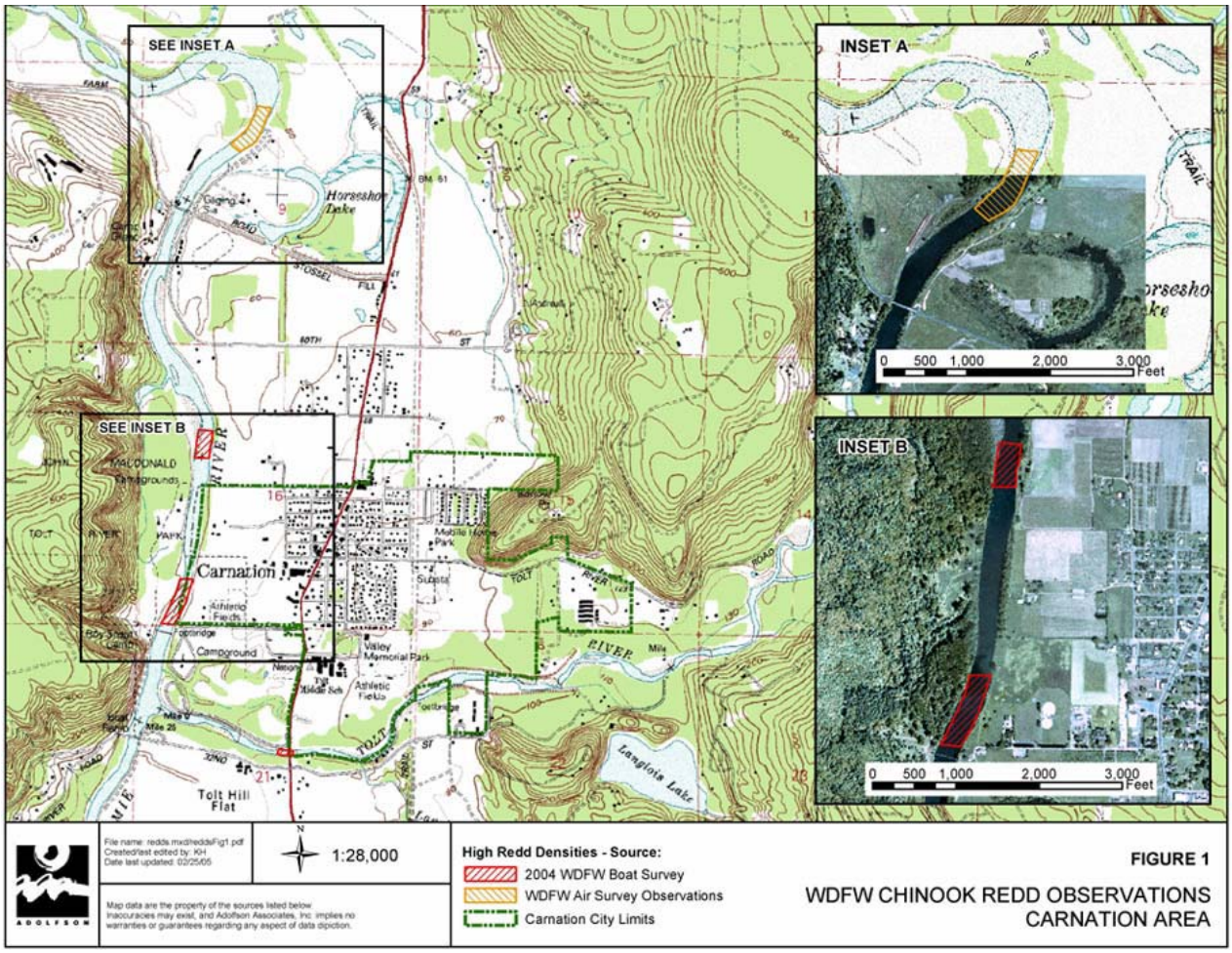

Figure 1. WDFW Chinook Redd Observations–Carnation Area

The TDR exhibits high quality characteristics for juvenile Chinook rearing, including moderate to high velocities and large pools and riffle pocket-water with extensive cobble and small boulder substrates. The condition of freshwater habitat may be of special importance for the Snoqualmie stock because, in contrast to most Puget Sound Chinook populations which are dominated by the "ocean-type" juvenile behavior, where juveniles spend a relatively short (three month) time in freshwater, Snoqualmie Chinook juveniles exhibit a relatively high (upwards of 30%) proportion of "stream-type" behavior, wherein juveniles spend upwards of a year in freshwater. As a result, they may have a higher reliance on freshwater habitat conditions than other Puget Sound Chinook stocks. There are no definitive studies as to why the Snoqualmie Chinook exhibit this behavior or whether they use Snoqualmie habitats or the TDR reach preferentially.

STEELHEAD TROUT

Steelhead trout are another salmonid with relatively high levels of spawning in the TDR. Curtis Kraemer, a senior biologist with WDFW(e-mail March 12, 2003 and March 13, 2003), described their general spawning use as follows: "…winter steelhead use the same reaches [*as Chinook*] with the highest density down by the Carnation Farm bridge." In 2004 (the only year for which WDFW data were made available), a total of 178 redds were counted in the TDR between April 2 and May 13. Of these, the majority (116, 65%) were spawned above the Carnation Farm Road bridge. Redd density averaged 58 redds/mile and 31 redds/mile above and below the bridge, respectively.

Steelhead juveniles typically spend two years in freshwater before migrating out to sea (Wydoski and Whitney 2004). No data are available on juvenile steelhead use in the TDR. It is likely, however, that the TDR is a highly productive area for juvenile steelhead rearing as they are known to rear in large river channels, especially upper ends of large pools and in higher-velocity riffle pocket water, such as this reach provides. The fact that this reach provides such habitat in close proximity to major spawning areas suggests this reach is a likely high use area for steelhead juveniles as well.

CHUM AND PINK SALMON

These species use the TDR for spawning, but formal surveys are not conducted for them. As a result, only limited, qualitative information is available about how chum and pink salmon use the TDR. Curtis Kraemer, a senior biologist with WDFW, describes spawning use by these species as follows (e-mail March 12, 2003 and March 13, 2003):

> "Pink use in the Snoqualmie is limited. In 2001 there were less than 1,000 pinks that spawned in the above reach - by far the highest counts in years."
>
> "The chum spawn in 2 general locations. One on stream bank left just downstream of the foot bridge at the Park. The second just upstream of the Carnation Farm bridge."

In addition, Kirk Anderson, Snoqualmie Basin Steward, has observed considerable use of the TDR by pink salmon with similar densities below the Carnation Farm Road bridge and in the vicinity of the Tolt-MacDonald Park footbridge.

Quantitative data on chum spawning is limited because high and often turbid water during their November–December spawning period prevents accurate counting of spawners.

Freshwater juvenile rearing by these species is short-term (days to weeks). Their juveniles tend to migrate to marine waters almost immediately after emerging from spawning gravel. Therefore, water quality and

other habitat conditions in freshwater will likely not impact chum and pink juveniles as much as other species of salmonids that spend one year or more in freshwater before beginning their seaward migration.

BULL TROUT

Bull trout are not known to spawn in the TDR. Typically they prefer very high quality, pristine (or nearly so) habitat, and extremely cold water for spawning and successful egg incubation (USFWS 2004). As a result, the USFWS (2004) has concluded that this part of the Snoqualmie is used by bull trout for sub-adult and adult foraging, migration and over-wintering. As confirmation of their use of the reach, a lone bull trout was observed in 2001 from the footbridge at Tolt MacDonald Park and a few bull trout have been caught in nearby Tolt River (Hans Berge, 2005, King County DNRP, personal communication).

COHO SALMON

Coho are generally considered tributary rather than mainstem spawners. As a result, directed spawner surveys for them are focused on streams that are much smaller than the Snoqualmie River. However, it is conceivable that some coho spawn in the TDR, where substrate, depth, and velocity conditions are adequate. Regardless, coho adults migrate through and juveniles are known to rear in the TDR. Some of the more productive coho spawning tributaries in the Snohomish River Basin are Snoqualmie River tributaries, including Griffin Creek and Harris Creek (Nelson 1996, Frissell 2000). Juveniles observed in the TDR may have migrated from tributaries such as these or could have resulted from spawning in the TDR or a combination of both places.

CUTTHROAT TROUT

Cutthroat trout are ubiquitous in Puget Sound streams exhibiting both freshwater-resident and migratory sea-run life histories (Wydoski and Whitney 2003). Based on occasional angler catches, they are known to be present in at least moderate numbers in the TDR. No formal spawner surveys are conducted for cutthroat trout. As with coho, they are believed to spawn primarily in tributaries rather than mainstem rivers. However, given proper substrate, depth, and velocity it is conceivable they would spawn in the TDR.

MOUNTAIN WHITEFISH

Mountain whitefish are common in Puget Sound rivers (Wydoski and Whitney 2003) and are known to be present in the Snoqualmie River, but there are no known studies of their use of the TDR. Anglers commonly catch them here suggesting that, at a minimum, they rear and mature in this reach. Given local substrate, depth, and velocity, it is probable but not confirmed, that they also spawn in it as well.

SOCKEYE SALMON

Sockeye are most common in large lake systems (Wydoski and Whitney 2003). However, small populations of riverine-based sockeye appear in most large Puget Sound rivers, including the Snoqualmie (WDFW et al. 1993). Little is known about the Snoqualmie sockeye, in particular whether they are a small, self-sustaining run or strays from other river systems with abundant sockeye populations, such as Lake Washington or the Baker River (Skagit). At least one has been caught by an angler and verified by

a county biologist in the Tolt River a short distance from the confluence with the Snoqualmie (Hans Berge, 2005, personal communication). Otherwise, little else is known about their use of the reach and whether the TDR plays a role in spawning or rearing.

SUMMARY AND CONCLUSION

There is considerable documentation of nine salmonid species in the TDR. At least four species (Chinook, chum, and pink salmon and steelhead trout) are known to use the area in moderate to very high numbers for spawning. Of these, chum and pink fry will spend little time (days) rearing in the TDR. Conversely, Chinook will rear for three months to a year and steelhead up to two years. Coho salmon, cutthroat trout, and mountain whitefish are not known to spawn in the TDR, although it's likely that at least a few do. Regardless, they rear and migrate extensively in the TDR. Bull trout use is most likely limited to sub-adult and adult foraging, migration and over wintering. Sockeye are present but their abundance and usage is uncertain.

Various recent studies and planning documents have noted the high use and value of the TDR for salmonids and have concluded that it is a high priority area for their protection and restoration, especially federally-listed Puget Sound Chinook salmon. Within the reach, based on data from a single year (2004), Chinook and steelhead spawn in slightly higher numbers and densities above the bridge than below it. Anecdotal information suggests this pattern is true for chum and pink salmon spawning as well. Limited detailed data on Chinook spawning distribution between the mouth of the Tolt River and the Carnation Farm Road bridge, shows two main clusters of redds, the largest of which is situated directly off-shore from the proposed treatment plant. Downstream of the Carnation Farm Road, there is one are of high intensity spawning starting roughly 1,500 feet downstream of the bridge.

Given the above information, a river discharge location at the Carnation Farm Road bridge would expose fewer fish to effluent and have lower risk than a discharge at the Tolt-MacDonald Park. An even lower incremental amount of risk would be achieved by discharge into off-channel wetlands that discharge downstream of the TDR, such as those that exist in the WDFW Stillwater Wildlife Management Area. In those wetlands, effluent exposure would likely be limited to rearing coho and cutthroat and, on rare occasion, a sub-adult or adult bull trout, which may use the wetland to feed on those species. Additionally, the effluent would get additional treatment via flow through the wetland and ultimately discharge into the Snoqualmie River below the TDR and below almost all mainstem spawning habitats.

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